REMARKS

The above-identified patent application has been amended and Applicants respectfully request that the claims be reconsidered and again examined.

Claims 5-11, 21 and 24-26 are pending in the application.

The Examiner indicated that the article "Dual-Output Hall Effect Switch" listed on the IDS filed on November 5, 2003 has not been considered since a copy of the article was not provided. A copy is provided herewith and consideration of the article is respectively requested.

Claims 5-11, 21 and 24-26 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 7-12 and 23-26 of U.S. Patent No. 6,356,741. Applicants file a Terminal Disclaimer herewith. Accordingly, it is submitted that the double patenting rejection should be removed.

As claims 5-11, 21 and 24-26 and the entire case are believed to be in condition for allowance, an indication thereof is respectfully requested.

If the Examiner has any questions concerning this amendment or this application, he is respectfully invited and encouraged to contact the undersigning attorney.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 01-0854.

Respectfully submitted,

Dated: 28 Dec 2004

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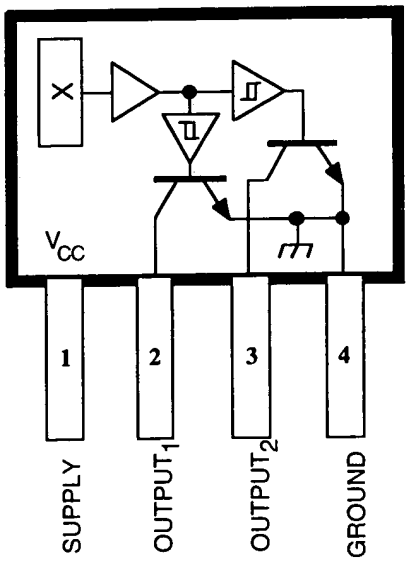
DUAL-OUTPUT HALL-EFFECT SWITCH



Dwg. PH-007

Pinning is shown viewed from branded side.

ABSOLUTE MAXIMUM RATINGS
at T_A = +25°C

Power Supply, V_{CC} . . . . . **25 V**
Reverse Battery Voltage, V_{RCC} . . . . . **-30 V**
Magnetic Flux Density, B . . . . . **Unlimited**
Output OFF Voltage, V_{OUT} . . . . . **25 V**
Output ON Current, I_{OUT} . . . . . **50 mA**
Operating Temperature Range,
T_A . . . . . **-20°C to + 85°C**
Storage Temperature Range
T_S . . . . . **-65°C to +150°C**

Type UGN3235K Hall-effect sensors are bipolar integrated circuits designed for commutation of brushless dc motors, and other rotary encoding applications using multi-pole ring magnets. The device features two outputs which are independently activated by magnetic fields of opposite polarity.

Each sensor IC includes a Hall voltage generator, two Schmitt triggers, a voltage regulator, output transistors, and on-board reverse polarity protection. The regulator enables these devices to operate from voltages ranging between 4.5 V and 24 V. On-chip compensation circuitry stabilizes the switch points over temperature.

Each open-collector output is independently operated by the proper amount and polarity of incident magnetic flux. Output 1 responds only to the positive flux from the south pole of a magnet, Output 2 to the negative flux from the north pole of a magnet. When the sensor experiences the field of a south magnetic pole greater than the maximum operate point of Output 1, that output switches to the LOW state and Output 2 is unaffected. When the incident flux falls below the minimum release point for Output 1, that output returns to the HIGH state and Output 2 remains unchanged.

Output 2 independently responds in the same manner to the negative flux from the north magnetic pole of a magnet. Figure 1 shows a zone in the region of 0 G, t_H, where both outputs are in the HIGH or OFF state. This constitutes a delay that is independent of rate of change of the incident magnetic field and ensures that both outputs are never ON simultaneously. This is an essential feature for driving brushless dc motors with a minimum of reactive transient currents.

The UGN3235K is supplied in a four-pin plastic single in-line package (SIP) measuring just 0.205" wide x 0.135" high x 0.060" thick (5.2 x 3.4 x 1.55 mm).

FEATURES

- Reliable and Rugged Magnetic Sensing Switch
- Two Outputs Independently Switched by North and South Poles
- Independent Actuation of Outputs Minimizes Inductive-Load Reactive Transient
- Built-in Hysteresis Minimizes Interference from Stray Fields
- Operates from 4.5 V to 24 V
- Outputs Compatible with All Logic Levels
- On-Board Reverse Polarity Protection
- Open-Collector, Active-Low Outputs

Always order by complete part number: **UGN3235K**

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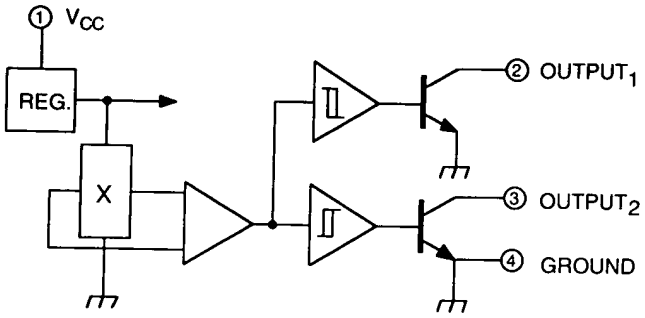
DUAL-OUTPUT HALL-EFFECT SWITCH

FUNCTIONAL BLOCK DIAGRAM



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ELECTRICAL CHARACTERISTICS at T_A = +25°C (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply Voltage	V_{CC}		4.5	—	24	V
Output Saturation Voltage	$V_{OUT(SAT)}$	V_{CC} = 24 V, I_{OUT} = 20 mA	—	160	400	mV
Output Leakage Current	I_{OFF}	V_{OUT} = 24 V, V_{CC} = 24 V	—	—	1.0	µA
Supply Current	I_{CC}	V_{CC} = 24 V, Output Open	—	6.0	8.0	mA
Output Rise Time	t_r	V_{CC} = 14 V, R_L = 820 Ω, C_L = 20 pF	—	0.04	0.4	µs
Output Fall Time	t_f	V_{CC} = 14 V, R_L = 820 Ω, C_L = 20 pF	—	0.18	0.4	µs

MAGNETIC CHARACTERISTICS at V_{CC} = 4.5 V to 24 V

Characteristic	Test Conditions	Output	Min.	Max.	Units
Operate Point, B_{OP}	T_A = +25°C	Q1	50	175	G
		Q2	-175	-50	G
	T_A = -20°C to +85°C	Q1	35	200	G
		Q2	-200	-35	G
Release Point, B_{RP}	T_A = +25°C	Q1	25	160	G
		Q2	-160	-25	G
	T_A = -20°C to +85°C	Q1	15	190	G
		Q2	-190	-15	G
Hysteresis, B_{hys}	T_A = +25°C	Q1 & Q2	15	100	G
	T_A = -20°C to +85°C	Q1 & Q2	15	110	G

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DUAL-OUTPUT HALL-EFFECT SWITCH

OUTPUT SWITCHING CHARACTERISTICS

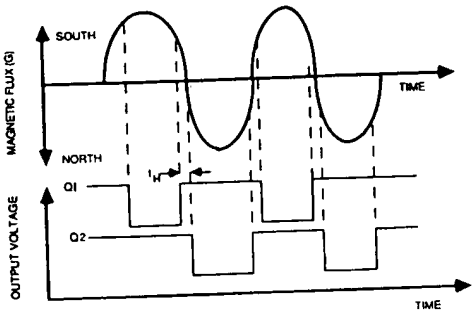


FIGURE 1

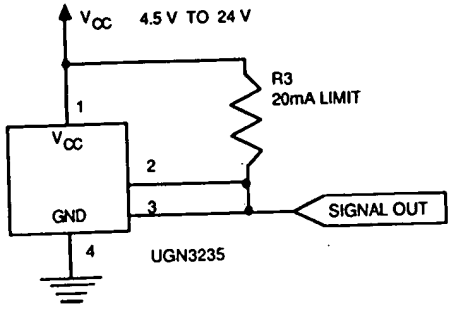


FIGURE 2A

MOTOR COIL DRIVER

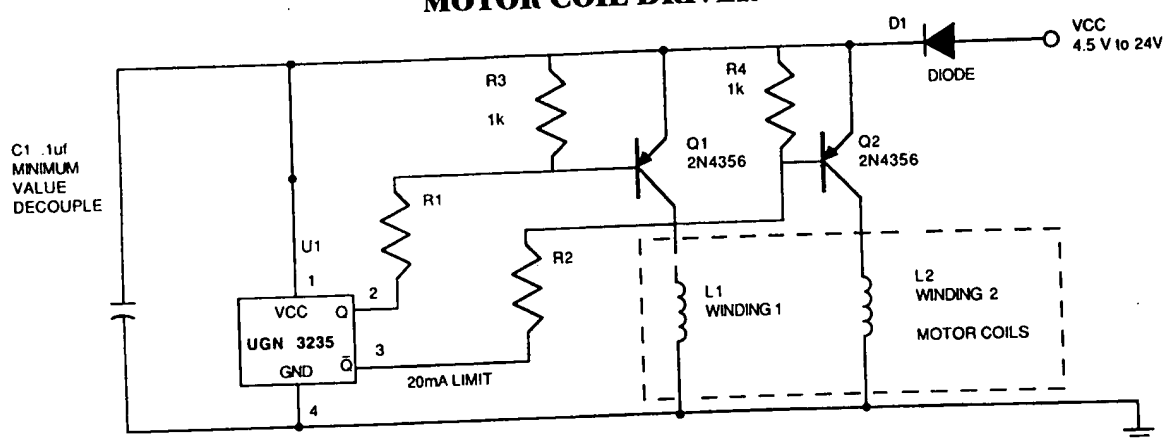
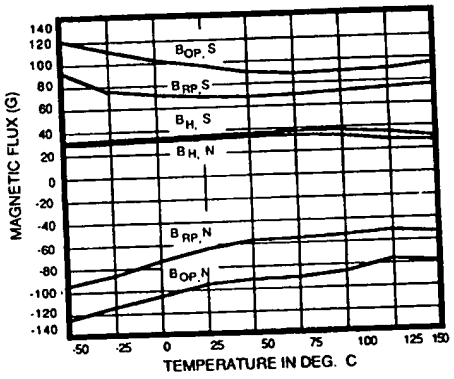


FIGURE 2B

SWITCH POINTS VERSUS TEMPERATURE

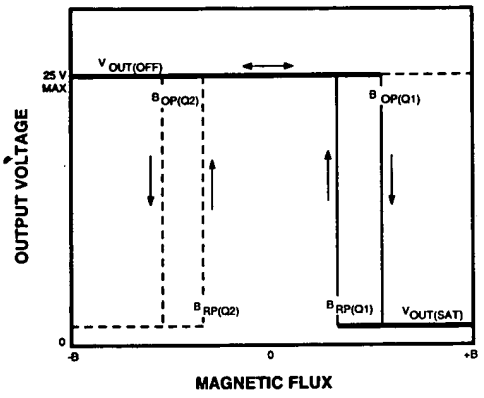


APPLICATIONS

Figure 2A gives a method of sensing the presence of either a north or south magnetic pole. Since the UGN3235K is an open collector device, it is possible to directly connect (OR-wire) the two outputs. This causes the output to go LOW when a north or south pole of sufficient magnitude is sensed.

The device connected in this manner suits many applications, ranging from doubling the resolution of a ring-magnet encoder, to zero-crossing detection. Figure 1 shows that t_H is centered around the zero-G portion of the magnetic field plot. Thus, by decoding the HIGH portion of the UGN3235K OR-wired output, the zero-crossing can be encoded.

HYSTERESIS CHARACTERISTICS



Dwg. GH-043

SENSOR LOCATION

(±0.005" [0.13mm] die placement)

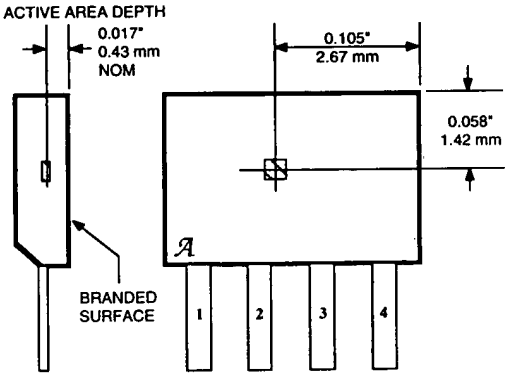


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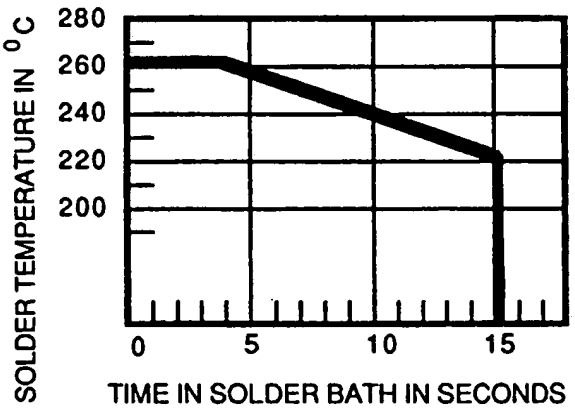
Figure 2B shows that the UGN3235K makes it possible to implement a very efficient brushless dc motor using a minimum number of components. Referring again to Fig. 1, the dead time (t_H) of the switching characteristics allow the motor coil fields to decay sufficiently. This avoids both excessive reactive voltages and the magnetic drag resulting from the motor coils working in opposition to each other.

GUIDE TO INSTALLATION



Dwg. No. A-12.062

1. All Hall effect integrated circuits are susceptible to mechanical stress effects. Caution should be exercised to minimize the application of stress to the leads or the epoxy package. Use of epoxy glue is recommended. Other types may deform the epoxy package.
2. To prevent permanent damage to the Hall cell, heat-sink the leads during hand soldering. Recommended maximum conditions for wave soldering are shown in the graph above.